# Energy, Work and Power

## Mark Scheme 3

| Level | IGCSE |
|---|---|
| Subject | Physics |
| ExamBoard | CIE |
| Topic | General Physics |
| Sub-Topic | Energy, Work and Power |
| Paper Type | (Extended) Theory Paper |
| Booklet | Mark Scheme 3 |

**Time Allowed:**      **59 minutes**

**Score:**      **/49**

**Percentage:**      **/100**

1  (a  (i)  KE = ½$mv^2$ in any form **OR** ½$mv^2$                                    C1
           (KE = 24.5 × 6.7 =) 164 J **OR** 160 J                                      A1

       (ii)  efficiency = output (power) ÷ input (power)
             **OR** <u>useful power</u> ÷ input (power)                                C1

             0.08 × candidate's **(a)(i)** correctly evaluated                         A1

   (b)        use of $\rho$ = $m$÷$V$ in any form **OR** $m$÷$V$                       C1
             ($\rho$ = 6.72÷5.6 =) 1.2 kg/m$^3$                                        A1

   (c)        rotation/movement of <u>wire</u>/coil **OR** rotation/movement of <u>magnet</u>   B1

             <u>consistent with above mark</u>: in magnetic field / between magnetic poles /
             cutting magnetic field **OR** in coil/near wire                          B1

                                                                              **[Total: 8]**


2  (a  (i)  (g.p.e. =) $mgh$ **OR** 0.15 × 10 × 1.8                                     C1
           2.7 J ignore minus sign                                                     A1

       (ii)  (k.e. **OR** 2.7 =) ½$mv^2$ **OR** ½ × 0.15$v^2$                          C1
             ($v^2$ =) 36                                                              C1
             6.0 m/s                                                                   A1

   (b) (i)  <u>initial</u> temperature (of metal) **OR** <u>final</u> temperature (of metal)
            **OR** temperature change (of metal)                                       B1

       (ii)  thermal energy transferred to something specific e.g. air/tube/stopper/
             thermometer/surroundings/environment
             **OR** small spheres lost before/after weighing
             **OR** not all the spheres fall the same distance                        B1

       (iii) higher temperature increase **OR** calculate mean of (100) readings       M1
             small measurements less accurate owtte                                    A1

                                                                              **[Total: 9]**

**3** **(a** **(i)** **1.** (loss of P.E. =) $mgh$ OR $92 \times 10 \times 1500$        C1
$1.38 \times 10^6$ J        A1
correct use of $mgh$ with $h = 500$ or 2000 gains 1 mark only

    **(ii)** **2.** (K.E. =) ½ $mv^2$ OR ½ $\times 92 \times 52^2$        C1
$1.244 \times 10^5$ J at least 2 sig. figs        A1

  **(a) (**   difference is due to:
(work done in overcoming) air resistance/drag
OR energy converted to/lost as heat (by air resistance/drag)        B1

  **(b)**   increases        B1

    **(ii)** 920 N        B1

                                                         **[Total 7]**

**4**   **(a)** **(i)** $(m = ) \rho V$ OR $1000 \times 1.8 \times 10^6$        C1
$1.8 \times 10^9$ kg

    **(ii)** (g.p.e. = )$mgh$ OR $1.8 \times 10^9 \times 10 \times 350$ (e.c.f. from **(a)(i)**)        C
$6.3 \times 10^{12}$ J (e.c.f. from **(a)(i)**)        A

    **(iii)** $(P = )E/t$ OR $6.3 \times 10^{12}/7$ OR $6.3 \times 10^{12}/(7 \times 60)$ OR $6.3 \times 10^{12}/(7 \times 3600)$        C1
(ecf from **(a)(i)(ii)**)
$2.5 \times 10^8$ W (e.c.f. from **(a)(i)(ii)**)        A

  **(b)**   continuously regenerated / not used up / everlasting supply
IGNORE used again / recycled / can be renewed        B1

    **(ii)** any **two** of: biomass/geothermal/solar/ tidal/wave/wind energy/wood
(NOT nuclear/light)        [9]

5   **(a**   **(i)**   (gravitational) potential energy to kinetic energy                     B1

          **(ii)**   chemical energy to (gravitational) potential energy              B1

              reference in **(i)** or **(ii)** to heat / thermal / internal energy produced   OR  work done against air resistance or friction                             B1

  **(b)**   **(i)**   (K.E. =) $\frac{1}{2}mv^2$ OR $0.5 \times 940 \times 16^2$                           C1
                $1.2 \times 10^5$ J                                           A

          **(ii)**   in words or symbols $Q = mc\theta$ OR $\theta = Q/mc$                   C1
                $1.203 \times 10^5 = 4.5 \times 520 \times \theta$ OR $\theta = 1.203 \times 10^5 / (4.5 \times 520)$       C1
                51 °C or K                                               A1

                                                   **[Total: 8]**

6   **(a**   (W.D. =) $F \times d$ **or** $640 \times 3.5$                           C1
        2240 J to 2 or more sig. figs.                           A1    [2]

  **(b)**     ($E$ =) $VIt$ **or** $75 \times 25 \times 4.0$ **or** $75 \times 100$ (accept ($E$ =) $VQ$ and $Q = It$)       C
              7500 J                                                   A1    [

          **(ii)**   (efficiency =) $\dfrac{\text{(useful) energy output}}{\text{energy input}}$ (× 100%) **or** 2240/7500

                (accept power for energy) (e.c.f. from **3(a)(i)** or **3(b)(i)**)                C1
                0.3 or 0.30 or 0.299 or 30 % or 29.9 % (e.c.f. from **3(a)(i)** or **3(b)(i)**)      A1

  **(c)**   any **two** from:
        electrical heating
        friction
        W.D. lifting suppor
        sound                                                       B2    [2]

                                                   **[Total: 8]**